DISCLAIMER

Savannah River Site

Computing Architecture

Migration Guide (U)

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Authorized Derivative Classifier

G. F. Hayhoe

Approved
for Public Release

Computing
   Architecture and
     Standards
      Team

Table of Contents

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Preface

In April 1991, the SRS Computing Architecture and Standards Team (CAST) published the *Savannah River Site Computing Architecture* (WSRC-IM-91-18-1), a vision for site computing for the 1990s. As an adjunct to that document, this *SRS Computing Architecture Migration Guide* was developed to assist site organizations in planning the steps necessary to incorporate the architecture into their environments.

This document was developed jointly by CAST and the Advanced Technology and Architecture Section (ATA) of the Information Resource Management Department (IRM). The following are the CAST members and ATA personnel who participated in that effort:

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1 Introduction

The *SRS Computing Architecture* is a vision statement for site computing which enumerates the strategies which will guide SRS computing efforts for the 1990s. Each strategy is supported by a number of feature statements which clarify the strategy by providing additional detail. Since it is a strategic planning document, the *Architecture* has sitewide applicability and endorsement but does not attempt to specify implementation details. It does, however, specify that a document will be developed to guide the migration from the current site environment to that envisioned by the new architecture.

The goal of this document, the *SRS Computing Architecture Migration Guide*, is to identify specific strategic and tactical tasks which would have to be completed to fully implement the architectural vision for site computing as well as a recommended sequence and timeframe for addressing these tasks. It takes into account the expected availability of technology, the existing installed base, and interdependencies among architectural components and objectives.

It should be emphasized that the *Migration Guide* does not represent a commitment by any organization to implement any of the items in a specified time period. Instead, site computing organizations will utilize the *Migration Guide* as an aid in preparing strategic and tactical plans for their organizations and in making recommendations to the facilities and users which they support. These plans must take into account constraints such as funding, staffing, existing workloads, production schedules, quality and security implications, business strategies, DOE order compliance, and so forth.

The *Migration Guide* is not a call for major increases in funding or wholesale conversion of existing computing environments. It is a call, however, for a continuing proactive redirection of resources toward the envisioned architecture where supported by a sound business case. New installations should be designed to be as consistent with the architecture as possible; migration from the current installed base will occur gradually as hardware and software become obsolete or are replaced due to changing business

requirements. Recommended migration timeframes should be interpreted in this context.

Migration items will be represented as site initiatives in the Information Technology Resources Long Range Plan (ITR). The ITR also includes resource information derived from schedule and budgeting formation supplied by site computing organizations. Figure 1 illustrates the relationships between the *Architecture*, the *Migration Guide*, strategic and tactical plans, and the ITR Long Range Plan.

Like the *SRS Computing Architecture,* the *Migration Guide* will be updated periodically to reflect changes in computing technologies, the site computing architecture, and the overall SRS environment. Additionally, the Computing Council and Computing Architecture and Standards Team (CAST) will conduct periodic assessments of architecture implementation progress within divisions and for functional areas. These assessments will identify migration tasks which have been completed, as well as those which require clarification or increased attention. They will also be used as input in refining the *Computing Architecture* and *Migration Guide.*

The following pages comprise the *Migration Guide.* Each strategy specified by the *Architecture* is listed, along with the supporting key features (shown in boxes). Following each key feature is a list of migration recommendations identified as steps leading to the implementation of that feature. Following the migration recommendations is a recommended implementation sequence and associated timeframes. All dates are based on calendar years.
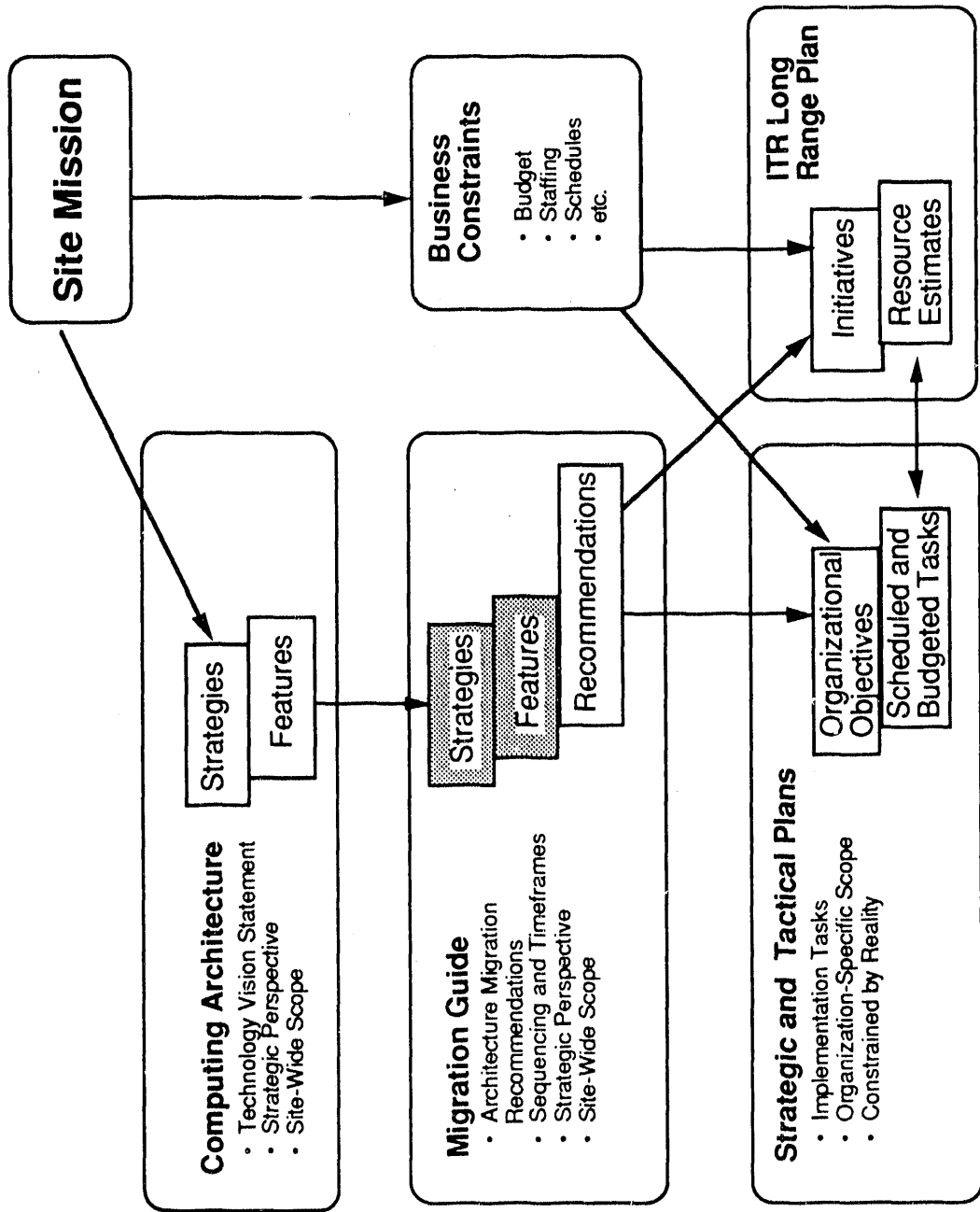
Figure 1:

**Interrelationships of the *SRS Computing Architecture*,
Migration Guide, and Planning Documents**

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2   Migration Recommendations for Standards

Architecture Strategy

S1   *A sitewide standards infrastructure will be established.*

Migration Recommendations

> *Sitewide Computing Council formed to set policy and address computing priorities.*

S1.1   Form Computing Council.

> *Computing Architecture and Standards Team (CAST) formed to recommend and implement policies and establish site computing architecture and standards.*

S1.2   Form Computing Architecture and Standards Team.

> *Creation of computing committees representing organizations and specialized areas of interest.*

S1.3   Form computing councils for divisions and functional areas (such as the Process Digital Equipment Committee and the Engineering and Scientific Computing Committee).

> *Sitewide standards and guidelines developed for computing technologies, methodologies, and products.*

S1.4   Issue company-level computing policies.

S1.5   Issue computing standards and guidelines.

S1.6   Issue company-level data administration policies.

S1.7   Lead establishment of site standards for business and office software.

> *Process Digital Equipment Committee to lead establishment of site standards for control and process monitoring systems.*

S1.8   Form PDEC Subcommittees for special process computing action tasks.

S1.9   Publish PDEC Supported Equipment List.

S1.10   Publish PDEC Process System Proprietary Source Code List.

> *Engineering and Scientific Computing Committee to lead establishment of site standards for engineering and scientific software.*

S1.11   Provide a unified direction for procurement and use of engineering software at SRS.

S1.12   Establish weighted guidelines for engineering and scientific software applications used at SRS.

S1.13   Develop a list of all engineering and scientific software used at SRS.

S1.14   Monitor engineering and scientific software selections to eliminate duplication.

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Recommended Migration Sequence *

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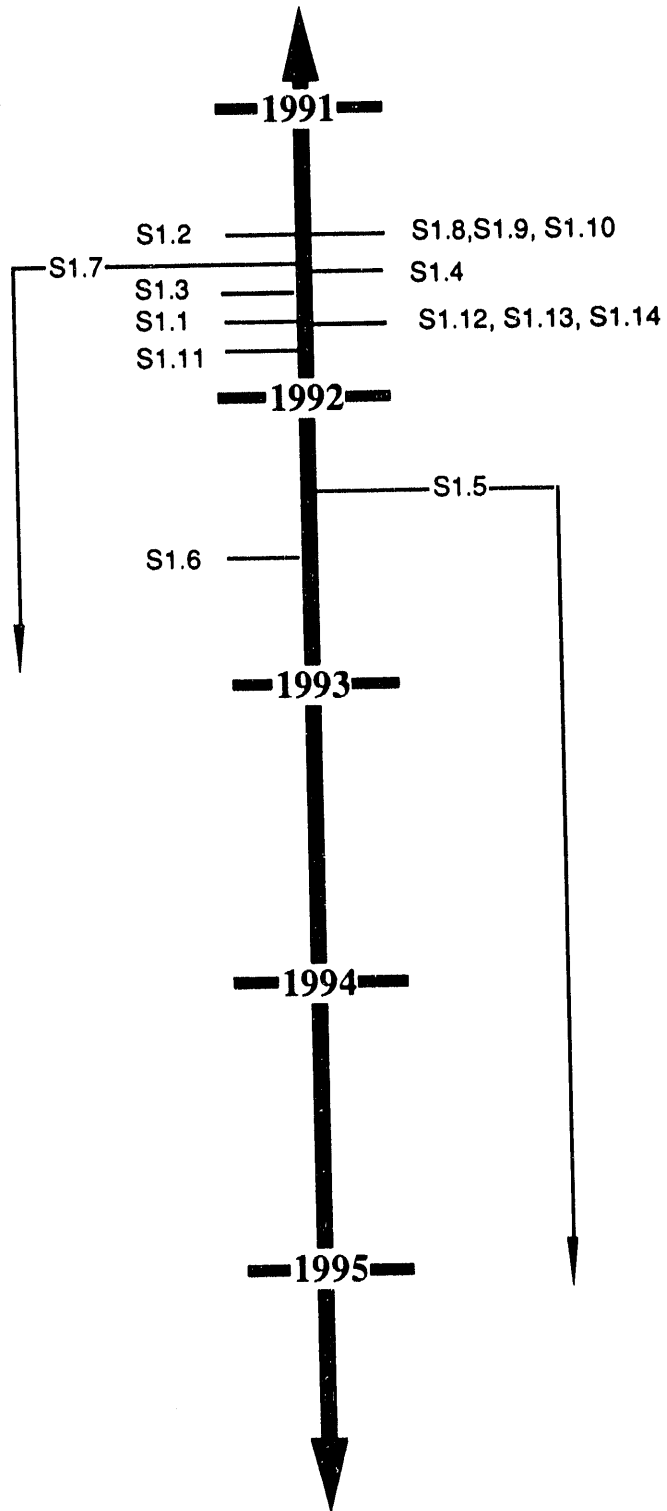
* Dates for guidance only.

Architecture Strategy

S2   *Where applicable, site standards will conform to international and national standards as well as government regulations and DOE orders.*

Migration Recommendations

> *Standards designed to promote interoperability of heterogeneous systems.*

S2.1   Research ASME, IEEE, and other standards bodies to ascertain what standards apply to computing.

S2.2   Research DOE orders and FIPs to ascertain what guidelines or standards apply to computing.

> *Adherence to Government Open Systems Interconnect Profile (GOSIP) as required by DOE order.*

S2.3   Publish GOSIP migration plan.

> *ISO and IEEE standards for local area network communications.*

S2.4   Publish site LAN standards.

> *Use of dominant proprietary standards and specific products required where open standards are not yet mature.*

S2.5   Identify applicable technology standards and categorize as to international/national/govermental or dominant proprietary.

S2.6   Identify applicable standard product groups and categorize relative to the associated technology standards.

Recommended Migration Sequence *

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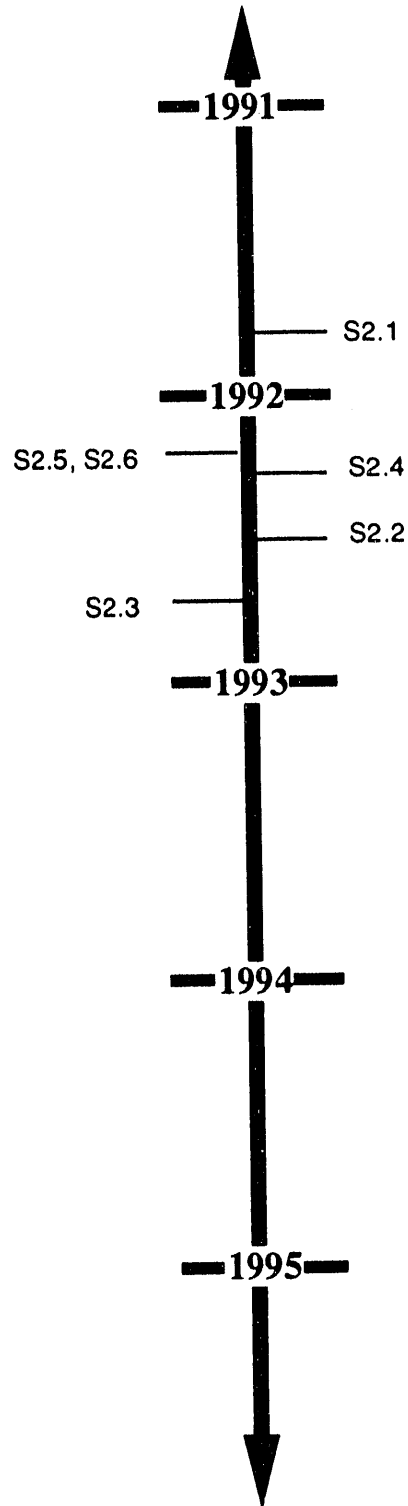
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3 Migration Recommendations for Data

Architecture Strategy

> *D1   Data will be managed as a site resource.*

Migration Recommendations

Identification of mission-essential data.

D1.1   Define and identify mission-essential data.

D1.2   Identify and segregate process control parameters from reportable process data.

Establishment of robust platforms, including workgroup servers as well as central computer systems, for mission-essential data.

D1.3   Establish workgroup database servers.

D1.4   Identify and migrate data from non-robust platforms to robust platforms.

Uniform standards for data collection, storage, and interchange.

D1.5   Identify existing systems which should be modeled and prioritize.

D1.6   Define standard modeling methodologies and tools.

D1.7   Establish standards for naming conventions, format, etc.

Maximum sharing of data, with appropriate protection constraints.

D1.8   Develop a plan for accommodating sensitive/UCNI information.

D1.9   Define and implement a data trusteeship program to improve the sharing and integrity of SRS data.

D1.10   Identify classified reportable process data.

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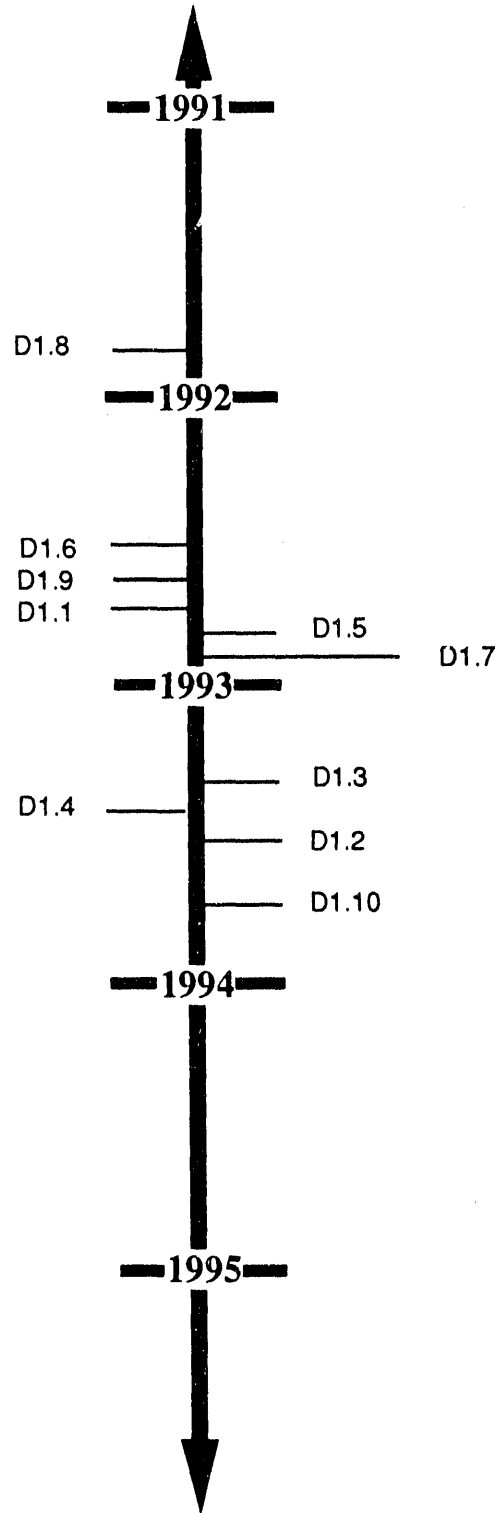
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Architecture Strategy

D2   *A relational database product will be implemented on the mainframe tier and the workgroup tier. Connectivity will be established between the products.*

Migration Recommendations

> *Transition of mainframe data and applications to a relational environment.*

D2.1   Complete a relational pilot with standard product.

D2.2   Establish migration policies/plans for existing applications/databases.

D2.3   Implement and populate a data dictionary for each major application.

D2.4   Develop first major new application using CCF standard RDBMS.

D2.5   Develop capability to access both relational and non-relational databases.

D2.6   Implement CCF relational database administration procedures/tools.

> *Standardization on a single workgroup relational database management system (RDBMS) product.*

D2.7   Select standard workgroup RDBMS product.

D2.8   Install standard workgroup RDBMS product.

D2.9   Implement workgroup database administration procedures/tools.

D2.10   Pilot relational database on a process computer host.

D2.11   Require that database product on new process computer host systems be relational.

> *Adoption of SQL database access language.*

D2.12   Select common database access tools.

D2.13   Conduct a Remote Data Access (RDA) pilot.

Linkage of workgroup and mainframe databases.

D2.14   Define connectivity and data partitioning among platforms.

D2.15   Implement database connectivity among products across platforms.

Transition (or augmentation) of relational database systems to support object-oriented programming.

D2.16   Conduct object-oriented database pilot.

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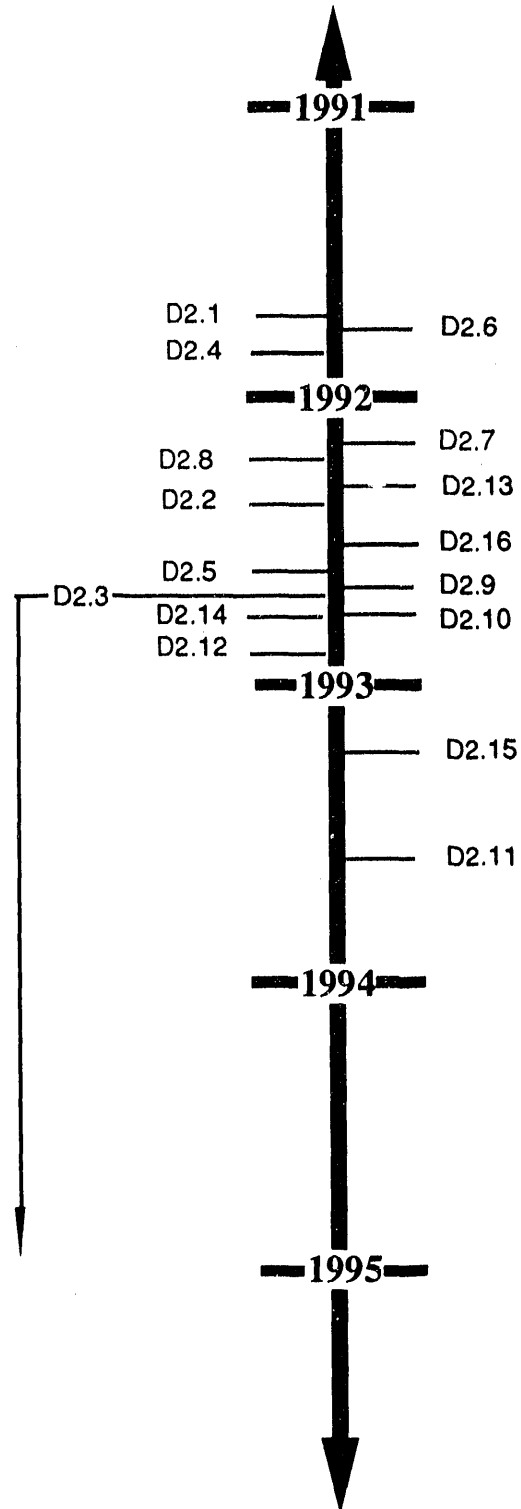
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Architecture Strategy

D3   *A sitewide data repository will be implemented for the storage of information describing site data and databases.*

Migration Recommendations

> *Consolidation of meta-data stored in independent data dictionaries.*

D3.1   Inventory and evaluate repositories and dictionaries used within SRS and at other locations.

D3.2   Populate the repository with information about SRS data.

> *Accessibility by all CASE and DBMS products.*

D3.3   Define the requirements for an SRS repository and select one that will meet long-term needs or that will properly serve the transition period until the optimum repository becomes available.

D3.4   Obtain and install the repository.

D3.5   Establish standards and guidelines for the management and use of the repository.

D3.6   Provide interfaces between a repository and DBMS dictionaries.

D3.7   Provide a tool set for managing the repository.

> *Implementation of site data model.*

D3.8   Categorize data into subject oriented groupings.

D3.9   Identify and categorize process data (i.e., reportable, classified, etc.).

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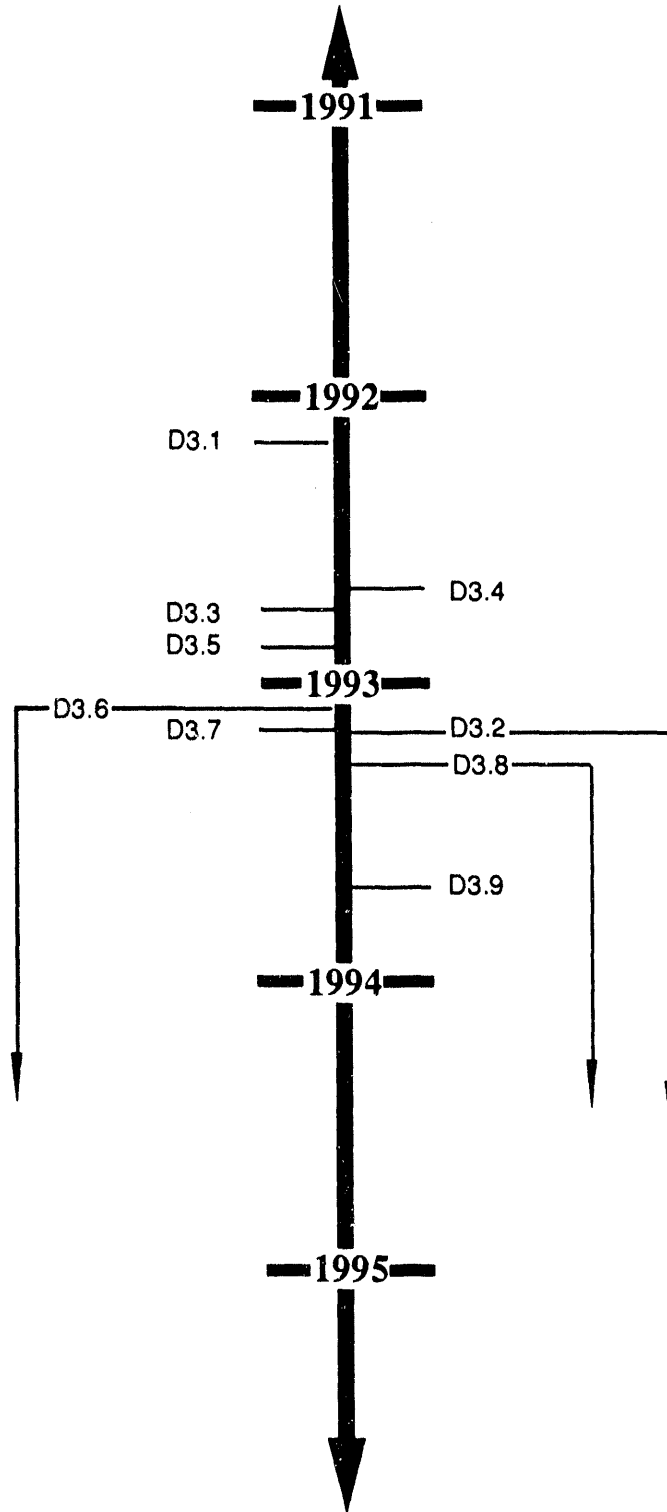
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Architecture Strategy

> **D4**   *Referential integrity will be imposed by the RDBMS wherever possible, instead of by individual applications.*

Migration Recommendations

> *Consistent implementation of integrity rules across applications.*

D4.1   Develop plan for the use of referential integrity in a multi-platform environment.

D4.2   Scrub, validate, and verify integrity of existing databases.

D4.3   Define and publish data integrity/accuracy requirements.

> *Rules stored in repository.*

D4.4   Load business rules for referential integrity into the repository.

D4.5   Derive referential integrity for RDBMSs from the business rules in the repository.

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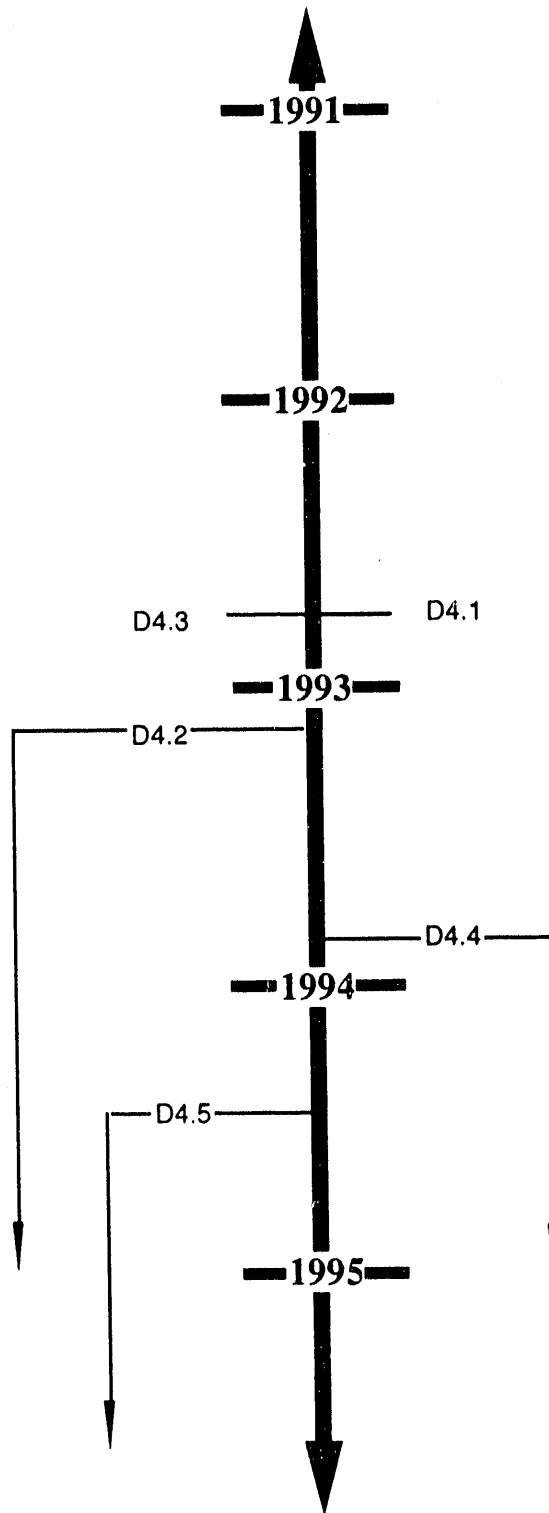
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Architecture Strategy

D5   *A sitewide data administration organization will be established.*

Migration Recommendations

> *Data Administration Steering Committee with division-level representation to provide senior management oversight of data policies.*

D5.1   Establish Site Data Administration organization, with policies and standards as required to support the functions.

> *Working-level Data Administration Coordination Group to coordinate implementation of data policies.*

D5.2   Form Data Administration Working Team (multi-divisional) to take steps leading to successful implementation of site data administration function.

D5.3   Define objectives, policies, infrastructure, and responsibilities for a site data management organization.

D5.4   Write an implementing plan for data management.

D5.5   Define value and benefits of data management.

Recommended Migration Sequence *

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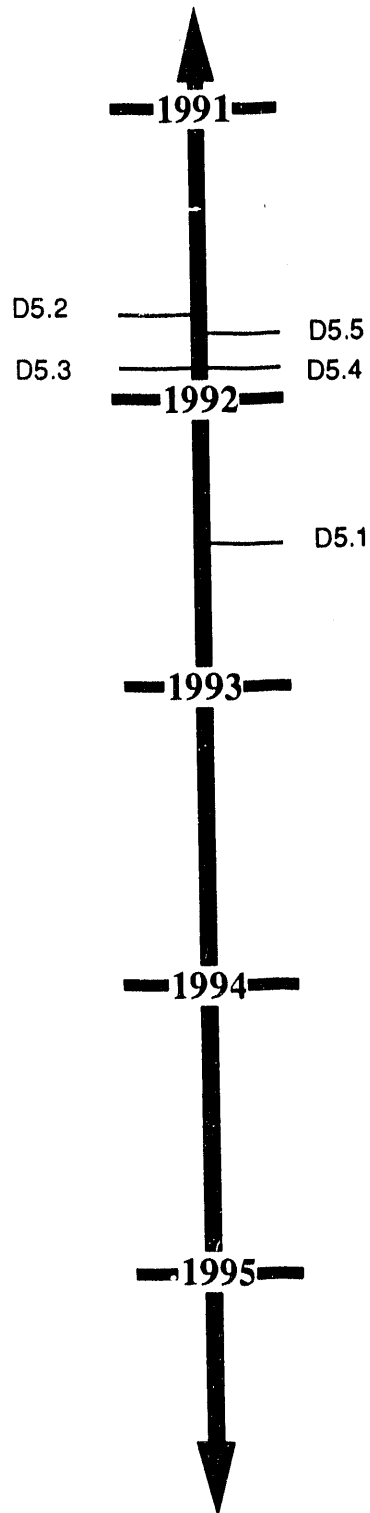
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4 Migration Recommendations for Platforms

Architecture Strategy

P1   *System acquisitions will be based on site standards guidelines.*

Migration Recommendations

| *Open systems encouraged by site standards.* |

P1.1   Develop guidelines for operating system selection and establish an environment for new system testing/development.

P1.2   Develop plan and schedule for migrating applications from non-strategic operating systems.

P1.3   Identify site standards for open systems.

P1.4   Develop and implement a plan to provide general computational services for sitewide use.

| *Increasing use of the UNIX operating system.* |

P1.5   Establish a UNIX system management group.

P1.6   Develop a plan for providing UNIX application services.

P1.7   Put systems in production use as file/database servers.

P1.8   Implement CCF UNIX print and file services.

| *Acceptance of multiple standards for personal workstations.* |

P1.9   Formalize standards for workstations.

P1.10   Establish policy to deliver equivalent functionality to all standard workstation platforms.

P1.11   Facilitate reallocation and excessing of existing workstations which are insufficient to support future environment.

P1.12   Define minimum platform standards by job function.

| *Identification and implementation of standard mechanisms for linking heterogeneous systems together at the application and database levels.* |

P1.13   Execute pilot projects using Distributed Computing Environment (DCE).

Site standards for system services that promote interoperability.

P1.14   Migrate to POSIX-compliant versions of operating systems.

Site standards for process control and monitoring systems.

P1.15   Publish PDEC Process Computer Procurement Standards: Vendor Quotation Requirements; Evaluation Criteria and Methodology, and Deliverables; and Tests Required Prior to Operation and Maintenance.

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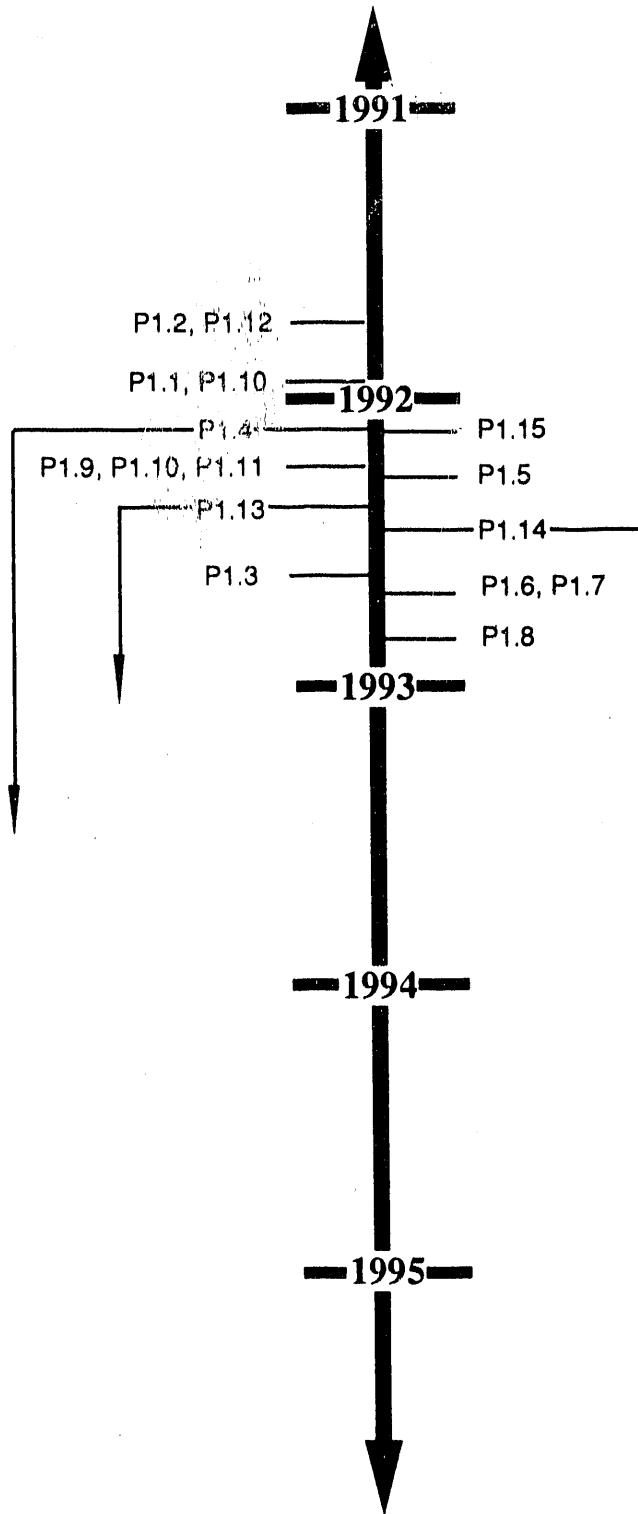
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Architecture Strategy

P2   *Systems and workstations will be closely integrated into the site computer network with supporting services.*

Migration Recommendations

> *High performance LAN interfaces for personal workstations.*

P2.1   Upgrade workstations from serial to direct network connections (Ethernet or Token-Ring).

P2.2   Identify and upgrade workstations requiring FDDI-equivalent data communications speeds.

> *Establishment of file, printer, and database servers at the workgroup level.*

P2.3   Develop guidelines for logical network locations for servers.

P2.4   Implement core software distribution/licensing/access via network.

P2.5   Implement department-wide LAN pilot.

P2.6   Develop workgroup server sizing and placement guidelines, and incorporate into site's Engineering Standards.

P2.7   Develop and implement management/operation guidelines for servers.

P2.8   Develop a server management organization.

P2.9   Develop a consistent policy for services to be provided by various servers.

P2.10   Develop a consistent policy for customer involvement with servers.

P2.11   Install workgroup servers for every group.

P2.12   Establish OS/2 pilot projects.

> *Site standards for workstation communication capabilities and supporting services.*

P2.13   Develop plan to ensure that host services are well supported for LAN users.

P2.14   Implement Network Management techniques.

Transition to workstation based office information systems.

P2.15   Provide workstation-oriented OIS services, using gateways as required for transition from host-oriented environment.

Increasing use of computers and data communications facilities in the conduct of routine site business functions.

P2.16   Pilot site-useful applications available only in LAN environment.

P2.17   Identify LAN/workgroup/workstation needs and develop an organizational and functional model showing those needs.
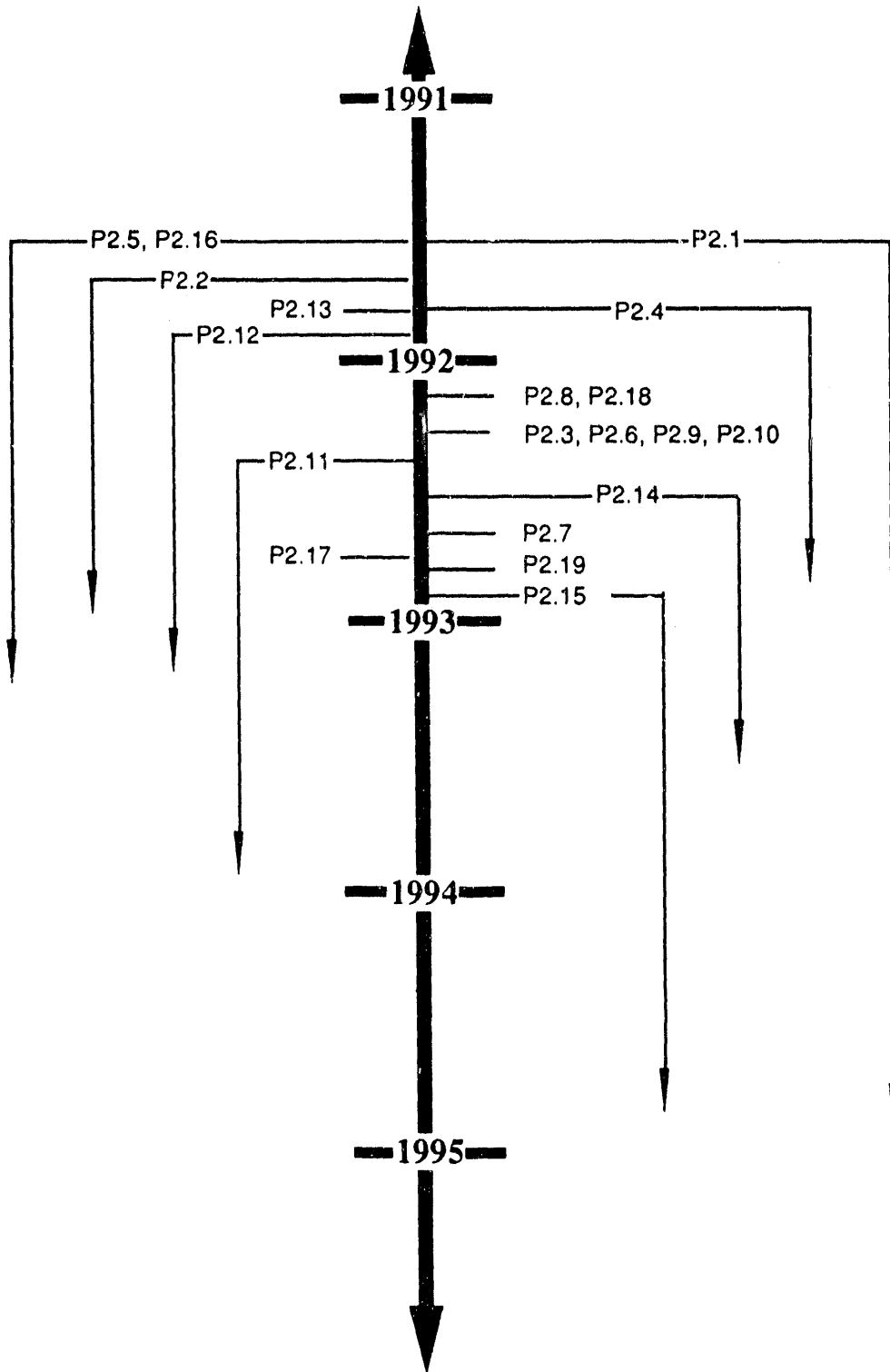
P2.18   Develop a workstation support organization, train personnel, and provide the hardware and software required to perform function.

P2.19   Improve availability of I/O devices from workstation (scanners, plotters, slide makers, high-speed printers, etc.).

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Architecture Strategy

P3 *Robust mission-essential computing and process control facilities will be maintained.*

Migration Recommendations

Resource utilization forecasting to schedule new systems and equipment upgrades to be available when required to support the site mission.

P3.1   Develop plan to support site scientific computing requirements.

P3.2   Replace IBM 3083 and forecast classified computing requirements.

P3.3   Replace 3081 consistent with disaster recovery plans.

P3.4   Investigate possible uses of the smaller mainframe model.

P3.5   Develop VAX system upgrade/redistribution plans.

P3.6   Forecast process control system upgrades.

Disaster recovery plans for Central Computer Facility and other systems essential for site operations.

P3.7   Develop and implement disaster recovery plans for the CCF systems.

P3.8   Develop and implement disaster recovery plans for workgroup servers.

P3.9   Provide for media storage facility consistent with disaster recovery plans.

Establishment of policies to keep hardware and system software on designated systems at levels supported by the vendor.

P3.10   Establish policy to get and keep system software up-to-date.

P3.11   Establish IBM development facility.

P3.12   Migrate 3090 to SYSPLEX.

P3.13   Implement automated operations.

> *Process control and monitoring systems to meet prudent as well as required levels of redundancy and fail-safe operation.*

P3.14   Review disaster recovery plans for process systems.

P3.15   Review spare parts inventory for process systems.

P3.16   Develop guidelines for redundant design for process systems.

P3.17   Develop guidelines for control system design: hardwired interlocks, software interlocks, PLCs, supervisory control, distributed control, etc.

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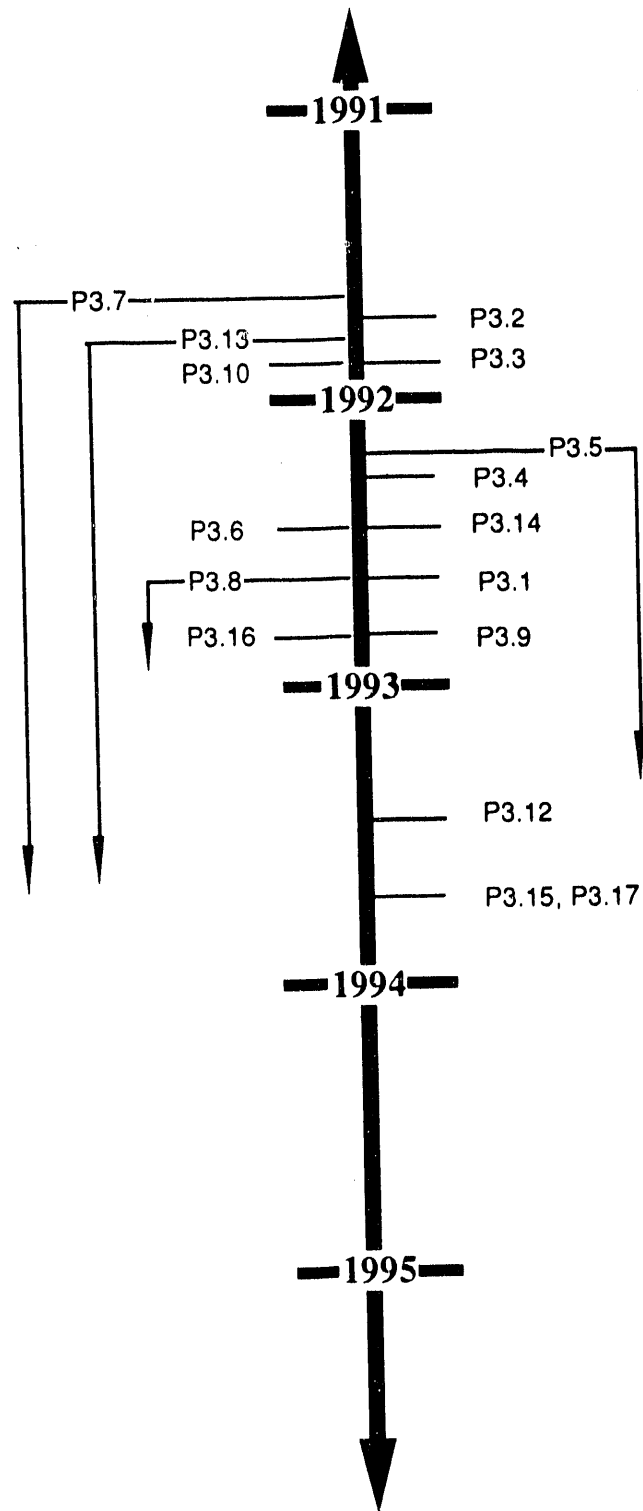
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Architecture Strategy

P4   *There will be a hierarchy of shared data storage*
capabilities provided for the site.

Migration Recommendations

Personal, workgroup, and central data stores.

P4.1   Develop hierarchical storage strategy and
management plan.

Shared facilities for cost efficiencies.

P4.2   Implement hierarchical storage strategy and
management plan.

Sufficient facilities to provide data backup for all platforms.

P4.3   Develop a plan to back up workstations and servers at
a location remote from the system itself.

P4.4   Develop a plan to transfer archived process data to
backup storage, including a plan for data retrieval.

Data migration from fastest (most expensive) storage to slowest (least expensive).

P4.5   Implement automated management for central
storage.

Ready access from site standard systems to shared storage.

P4.6   Convert Common File System (CFS) to standards-
based alternative network file system.

Recommended Migration Sequence *

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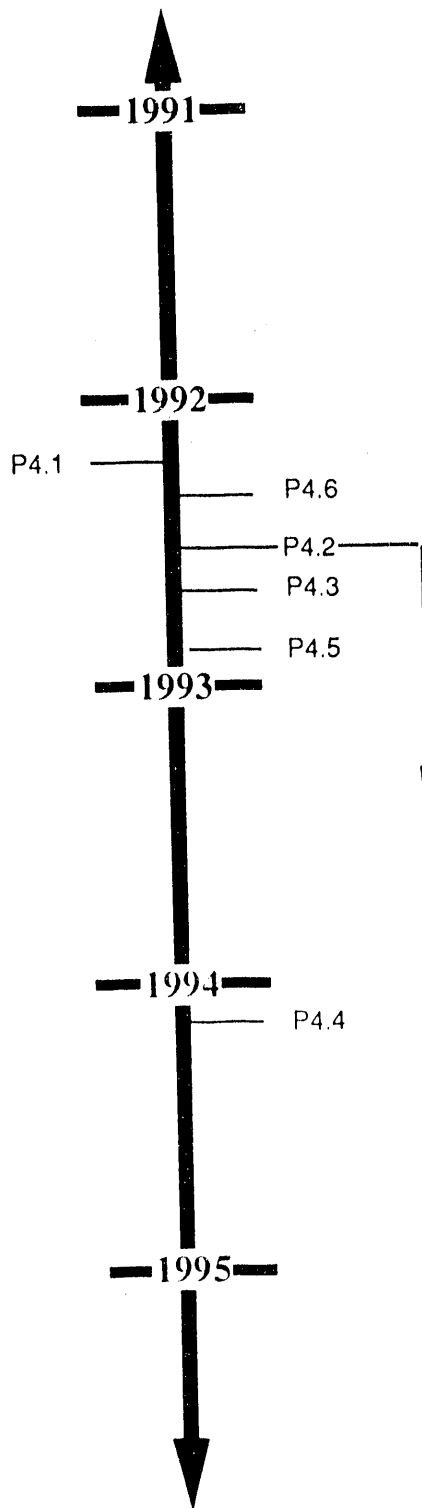
* Dates for guidance only.

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5 Migration Recommendations for Communications

Architecture Strategy

C1   *Data communications services and products will be based on standards.*

Migration Recommendations

> *Phase out of proprietary communications protocols in favor of open protocols (TCP/IP and OSI).*

C1.1   Develop an addressing scheme for protocols that are in use.

C1.2   Phase out proprietary protocols in use at SRS.

C1.3   Migrate from Ethernet to 802.3.

C1.4   Install TCP/IP on strategic platforms.

C1.5   Implement OSI pilots: FTAM, X.400, X.500, etc.

C1.6   Develop links between PC LANs and the overall OSI network.

C1.7   Migrate VAXes to Phase V DECnet.

C1.8   Install OSI software on strategic platforms.

C1.9   Encourage procurement of process computer systems or gateways that use or connect to open protocols.

C1.10   Establish process computer vendor requirements with respect to communication protocols and standards such as TCP/IP and GOSIP.

> *Development of a network operations and management infrastructure to support open protocols.*

C1.11   Support name servers for TCP/IP and OSI.

> *Rework of SRS network backbone to establish separate area networks with communications based on high performance routing of data between areas.*

C1.12   Develop an SNA integration plan.

C1.13   Develop routing plans for all routable protocols and phase out inter-area bridging.

> *Establishment of site standards for communications products for personal workstations, control systems, and host computer systems.*

C1.14   Establish standards for host and workstation interfaces.

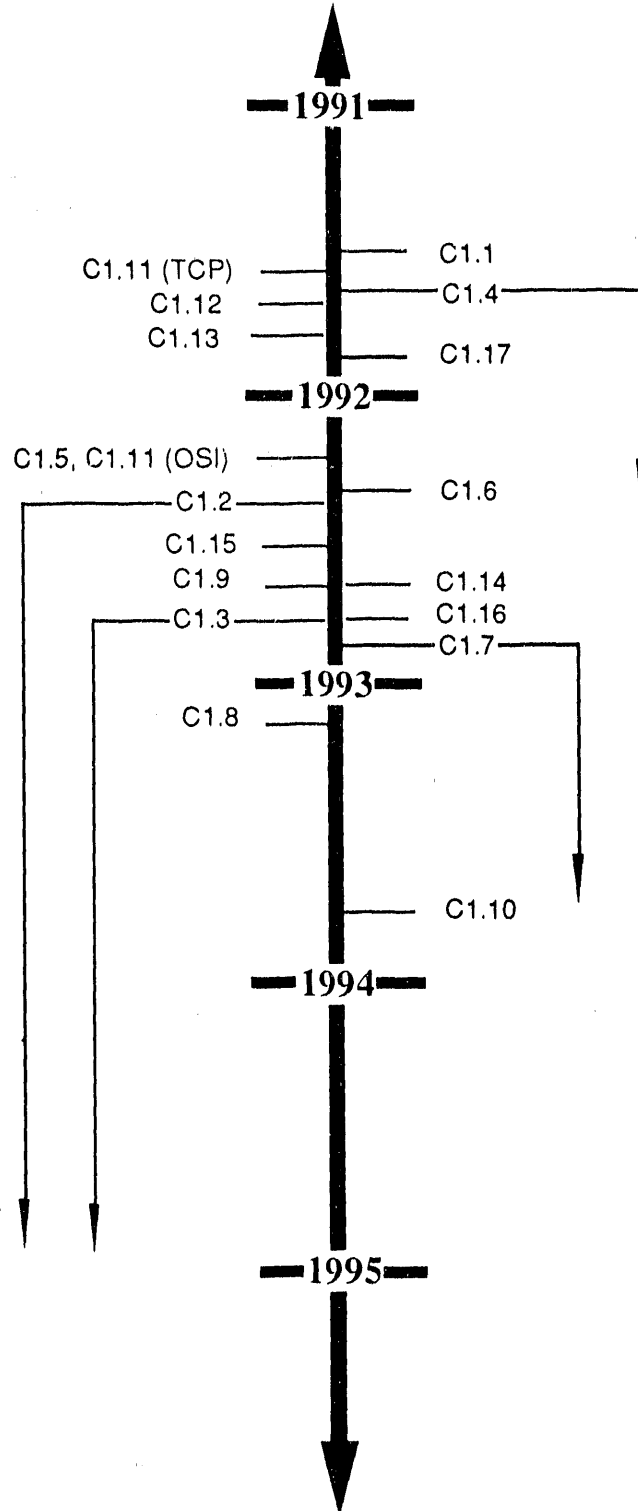C1.15   Phase out non-standard products (e.g., ARCNET).

> *Development of network-based security features based on industry standards.*

C1.16   Develop a plan for implementing the data encryption standard.

C1.17   Pilot Kerberos network security server.

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Recommended Migration Sequence *

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                   ━━1991━━

        C1.11 (TCP) ──────  ──── C1.1
        C1.12       ──────  ───C1.4───────────┐
        C1.13       ──────  ──── C1.17         │
                   ━━1992━━                     │
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   C1.5, C1.11 (OSI) ──────  ──── C1.6          │
           ──C1.2──────── ──────                ↓
        C1.15      ──────
        C1.9       ──────  ──── C1.14
        ──C1.3────── ──────  ──── C1.16
                               ───C1.7───┐
                   ━━1993━━               │
        C1.8       ──────                 │
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                               ──── C1.10
                   ━━1994━━




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* Dates for guidance only.

Architecture Strategy

C2   *The site network will be composed of robust LAN trunks and inter-area (facility) links.*

Migration Recommendations

> *Heavy reliance on fiber optic technology for data communication, including Fiber Distributed Data Interface (FDDI) local area networks and interarea fiber links.*

C2.1   Incorporate FDDI into site network.

C2.2   Develop an inter-area high speed network plan.

C2.3   Implement Hyperchannel conversion to FDDI.

C2.4   Develop high speed network plans beyond FDDI.

> *Dedicated facilities for process control LANs.*

C2.5   Develop site standards for process data highways; including grounding, lightning protection, cable conduit, etc.

C2.6   Develop gateways to process LANs.

C2.7   Develop architecture and guidelines for connecting process computers to the site network (i.e., gateways, routers, etc.)

> *Proactive network monitoring and management.*

C2.8   Document the existing SRS networks.

C2.9   Establish proactive monitoring/configuration of networks.

C2.10   Develop a network maintenance plan.

C2.11   Establish configuration control policies; establish regular network audits.

C2.12   Establish network support 7 days/week, 24 hours/day.

C2.13   Develop a support policy for networks outside the 700-Area.

High-speed connections to WSRC/BSRI offsite locations.

C2.14   Determine level of network services to be provided at offsite locations.

C2.15   Develop a strategy for network services to customers other than WSRC and the other contractors at SRS.

C2.16   Publish network security management plan; include offsite connections.

C2.17   Establish Internet connectivity.

C2.18   Install X.25 gateway.

Enhanced disaster recovery capabilities.

C2.19   Develop alternate telecommunications facility.

C2.20   Develop a network disaster recovery plan including relationships to the CCF disaster recovery plan and the telephone disaster recovery plan.
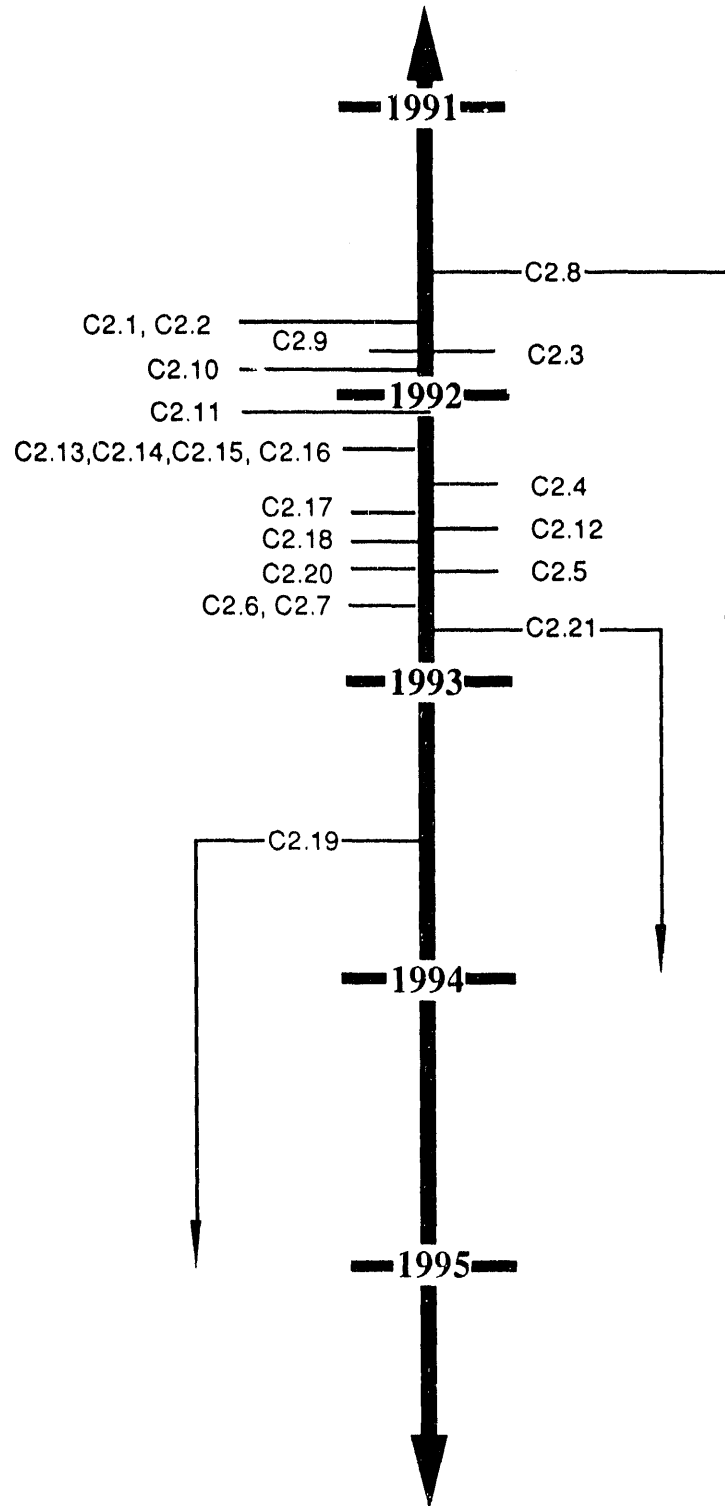
Classified systems and networks separated from unclassified systems and networks.

C2.21   Upgrade classified CCF network access from site areas.

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Recommended Migration Sequence *

* Dates for guidance only.

Architecture Strategy

C3 *Workstations and host computers will connect directly to the site LAN.*

Migration Recommendations

> *Migration of workstations from serial to direct local area network connections.*

C3.1   Upgrade LANs to support LAN attached workstations.

C3.2   Develop an FDDI-workstation network support plan.

> *Convergence of central computer facility network with site local area network.*

C3.3   Develop a second-generation CCF LAN.

C3.4   Provide SNA support for Ethernet workstations.

C3.5   Provide FDDI connection for IBM mainframes.

> *Standards in communications protocols to permit maximum interoperability between diverse workstations and systems.*

C3.6   Provide LAN support for TCP/IP.

C3.7   Migrate to OSI protocols.

C3.8   Determine appropriate standard protocol for process system gateways or nodes.

> *Phase out non-intelligent workstations (terminals).*

C3.9   Replace serial attached terminals with networked workstations.

> *Completion of wiring sitewide to support LAN access to every desktop.*

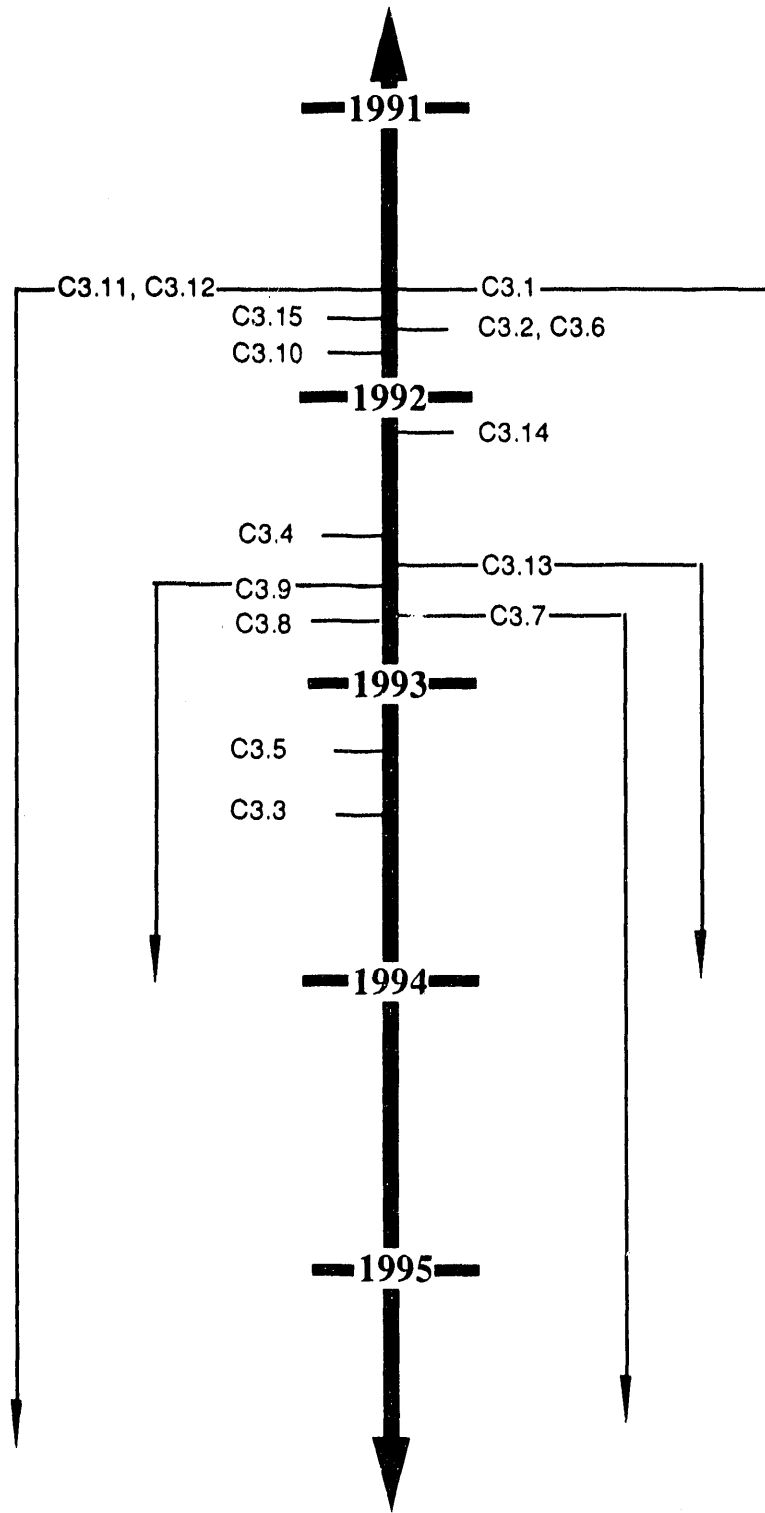C3.10   Redefine site universal wiring and incorporate into Engineering Standards.

C3.11   Install universal wiring at every workstation location.

C3.12   Install intra-area wiring (multi-mode fiber).

C3.13   Install inter-area wiring (single mode fiber).

C3.14   Develop a network interconnection MRP.

C3.15   Develop a Token Ring integration strategy for the CCF network.

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Recommended Migration Sequence *

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        ━C3.11, C3.12━━━           ━C3.1━━
              C3.15 ━               ━ C3.2, C3.6
              C3.10 ━
                          ━1992━
                                    ━ C3.14

             C3.4 ━
                                 ━C3.13━━
             ━C3.9━
             C3.8 ━     ━ ━C3.7━━
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             C3.5 ━

             C3.3 ━


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* Dates for guidance only.

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6 Migration Recommendations for Applications

Architecture Strategy

A1 - The development and purchase of software will be based on site standards.

Migration Recommendations

Standards included in site software acquisition and development procedures.

A1.1   Develop a procedure for software acquisition and development based on standards.

Site standards for languages and development tools.

A1.2   Define language selection criteria (CASE, GUI, SQL, callable, etc.).

A1.3   Evaluate languages and tools for host and workstation application development.

A1.4   Publish standards for language and development tools.

A1.5   Define language selection criteria for process parameter definition.

A1.6   Evaluate alternative languages used in process system source code.

Standards to promote cross system interoperability.

A1.7   Identify key cross-system interoperability issues.

A1.8   Evaluate new applications for interoperability with existing applications.

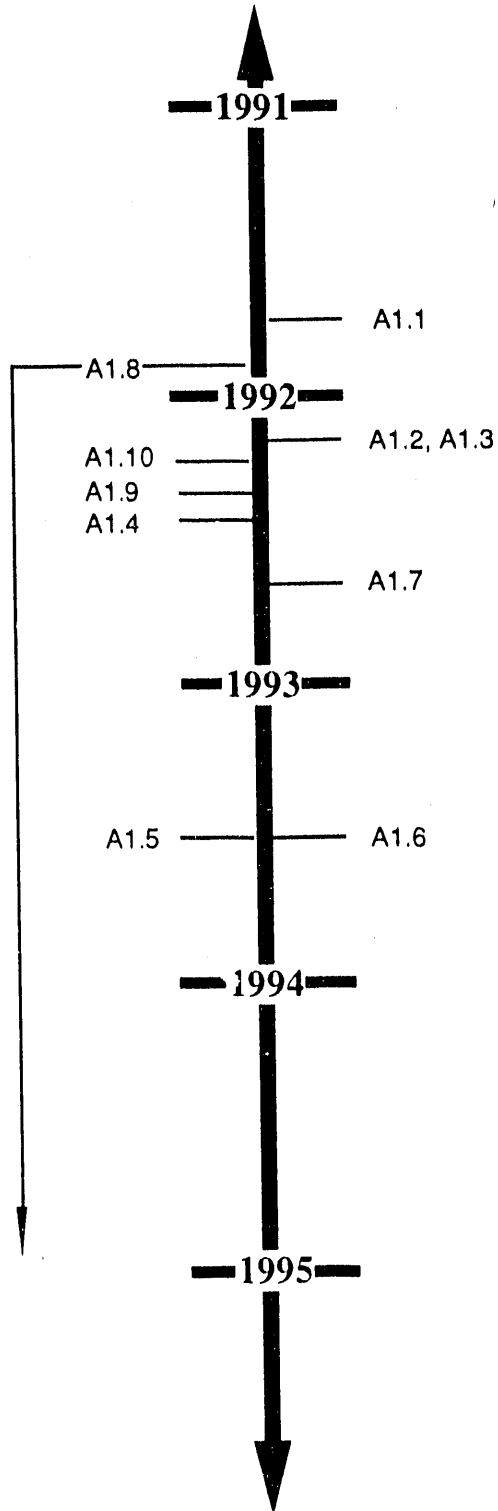| Development of an application migration / conversion policy. |
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A1.9   Develop application migration/conversion policy.

Building of an information systems "applications" architecture.

A1.10   Prepare inventory of existing applications and document interactions.

Recommended Migration Sequence *

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                         ┃──── A1.1
        ┌──── A1.8 ──────┫
        │           ━1992━
        │                ┃──── A1.2, A1.3
        │   A1.10 ───────┃
        │    A1.9 ───────┃
        │    A1.4 ───────┃
        │                ┃──── A1.7
        │                ┃
        │           ━1993━
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        │   A1.5 ────────┃──── A1.6
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                    ━1995━
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* Dates for guidance only.

Architecture Strategy

A2   Off-the-shelf software will be used to the maximum extent possible.

Migration Recommendations

Incorporation of make versus buy decision into site standard systems development methodologies.
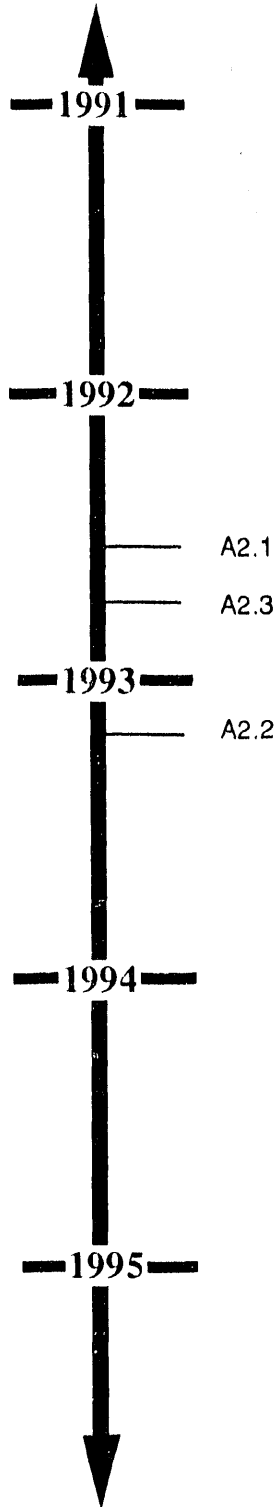
A2.1   Inventory and evaluate in-house-written process software.

A2.2   Establish a review function via DOE 1330.1C to ensure that a buy alternative has been adequately considered in system implementations.

Adoption of industry-standard applications/practices.

A2.3   Establish a list of industry-standard applications and practices and incorporate a review of the list into SRS development methodologies.

Delivery of greater functionality for a given amount of effort.

Recommended Migration Sequence *

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            ━━ 1991 ━━



            ━━ 1992 ━━



                   ┣━━━━  A2.1

                   ┣━━━━  A2.3

            ━━ 1993 ━━

                   ┣━━━━  A2.2



            ━━ 1994 ━━



            ━━ 1995 ━━



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* Dates for guidance only.

Architecture Strategy

A3   CASE and other computer-based tools will be used to automate the building of applications.

Migration Recommendations

Automation of software development methodologies.

A3.1   Define guidelines for CASE products.

A3.2   Implement CASE products.

A3.3   Incorporate CASE into SDMs.

A3.4   Implement supporting tools for standard languages.

A3.5   Evaluate current CASE tools used by process control vendors and SRS developers.

A3.6   Specify CASE tool(s) that will work with the majority of process control vendor products.

Active links to site data repository.

A3.7   Develop enterprise entity-relationship and object model.

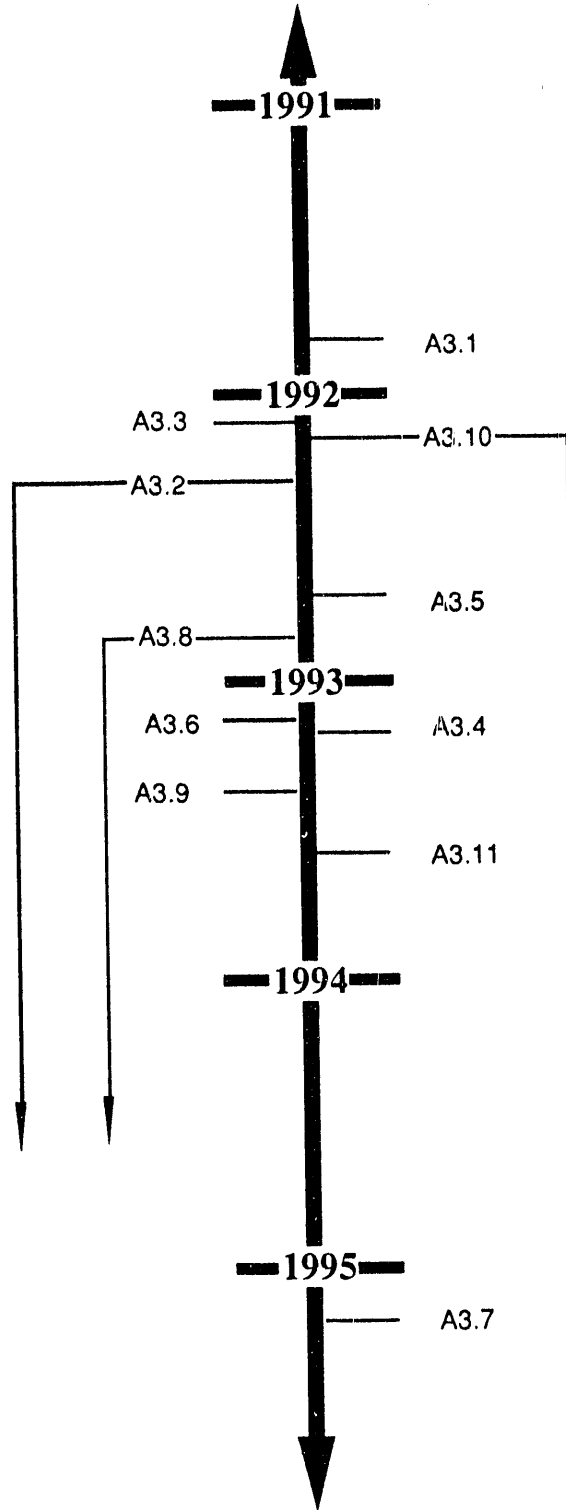| Application development centered at the workstation. |
|---|

A3.8   Implement languages and support environment on workstations.

Software configuration management.

A3.9   Select and install software configuration management product(s).

A3.10   Incorporate software configuration management into SDMs.

A3.11   Load existing software into configuration management environment.

Data-driven process control systems.

Recommended Migration Sequence *

A3.1

1991

1992

A3.3 ——— A3.10 ———

—A3.2———

A3.5

—A3.8———

1993

A3.6 ——— A3.4

A3.9 ———

A3.11

1994

1995

——— A3.7

* Dates for guidance only.

Architecture Strategy

A4   Applications will become modular.

Migration Recommendations

> Applications as collections of functions that can be accessed independently.

A4.1   Develop guidelines for code modularity and reusability.

A4.2   Define site applications architecture.

> Functions or modules defined to a site repository to facilitate reuse.

A4.3   Establish a module ac .ninistration function.

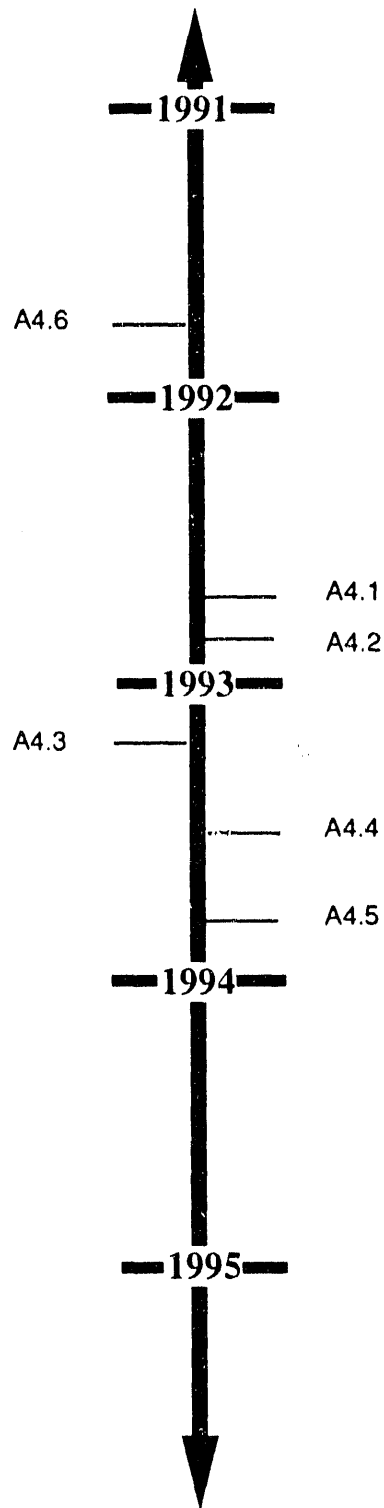A4.4   Establish site libraries of process system modules by vendor.

> Development of linkage of major application systems via cross-system procedures that can work across the site network (remote procedure calls or RPCs).

A4.5   Develop applications in languages which support RPCs.

> Object-oriented programming.

A4.6   Implement object-oriented programming pilot.

Recommended Migration Sequence *

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              ━1991━


      A4.6    ───┤

              ━1992━



                 ├───  A4.1
                 ├───  A4.2
              ━1993━

      A4.3    ───┤


                 ├···─  A4.4

                 ├───  A4.5
              ━1994━




              ━1995━




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* Dates for guidance only.

Architecture Strategy

A5 *Applications will conform to site standards for common*
graphical user interfaces.

Migration Recommendations

Definition of site standards for graphical user interfaces
(GUI).

A5.1   Decide which GUIs SRS will support.

A5.2   Define the boundaries of common features vs. user-
configuration within GUIs at SRS.

A5.3   Define GUI standards for SR-written software and
purchased packages.

Establishment of GUI-based operating systems for site
personal computers.

A5.4   Define standard GUI configurations.

A5.5   Implement standard GUI configuration within pilot
LAN.

A5.6   Make MS-Windows available to users.

A5.7   Establish EUS mechanism to install standard
configuration GUIs on new and newly connected
workstations.

Inter-application consistency and ease of use.

Migration of some existing applications to GUI-based
implementations.

A5.8   Identify and promote strategic GUI applications.

A5.9   Train analysts and developers on GUIs.

A5.10   Identify tool sets required to build GUI enhanced
applications.

A5.11   Develop a plan for incorporating CASE tools into GUI
development.

A5.12   Develop first applications with embedded graphical
orientation.

Workstation-supplied GUI for client-server applications.

A5.13   Select standard X development toolkit.

A5.14   Select X-Windows server for all strategic platforms.

A5.15   Define the interfaces between GUIs and other client-server components.

Multi-media (graphics and images) support under GUI.

A5.16   Implement pilot using standard GUIs.

A5.17   Define level of support for alternative input/output technologies.

Site guideline for process operator displays, alerts, alarms, and interactions.

A5.18   Summarize common denominators for human interfaces to process control systems.

A5.19   Establish standards that satisfy process safety and incorporate GUI; including visibility, operator activities (keyboard/input, acknowledgment, permissives, control actions), alarm notification, permanent record (alarms, etc.) requirements, etc.

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Recommended Migration Sequence *

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        A5.5 ─────────┐         ┌─A5.6─────────┐
                        ══1992══
        A5.8 ─────────        ───── A5.7
                                    ───── A5.1
  A5.2, A5.3, A5.4 ─────────
       A5.17 ─────────        ───── A5.18
                        ══1993══
    A5.9, A5.10 ─────────
       A5.12 ─────────
       A5.11 ─────────
                              ───── A5.16       │
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       A5.19 ─────────
A5.13, A5.14, A5.15 ─────────
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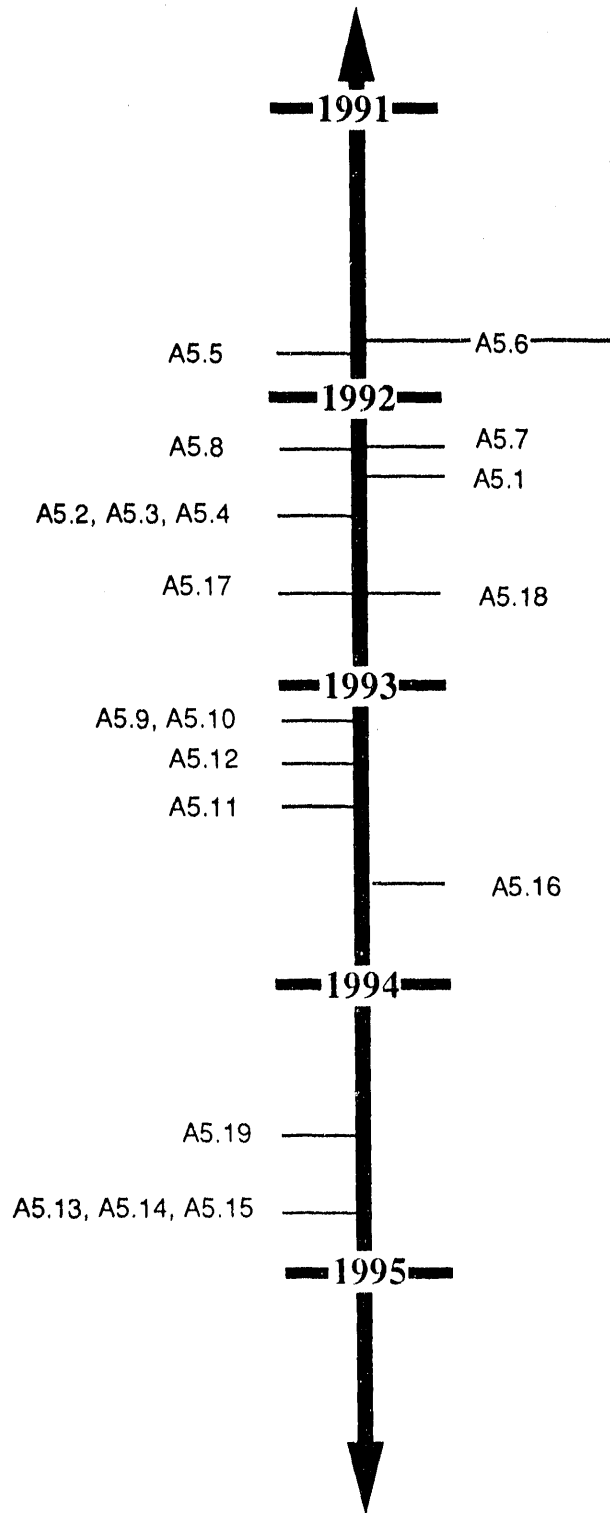
* Dates for guidance only.

Architecture Strategy

> *A6   The capabilities of the intelligent workstation will be a key component of the architecture.*

Migration Recommendations

> *Increasing computational power of the workstation to be utilized.*

A6.1   Identify and upgrade workstations which require additional computing power.

> *Linkage of workstations directly (high speed) to site network.*

A6.2   Identify and upgrade workstations requiring FDDI-equivalent data communications speeds.

> *Transition of the workstation (personal computer) to client role in client-server computing.*

A6.3   Develop guidelines for module development in a client-server environment.

A6.4   Develop criteria for determining application partitioning and operating platforms.

A6.5   Develop migration plans for standalone PC applications to client-server applications.

A6.6   Proceduralize code so it can be called remotely.

A6.7   Develop workstation-based data entry pilot.

A6.8   Develop application migration/conversion policy.

A6.9   Develop network performance guidelines for applications.

A6.10   Establish standards for client-server applications.

A6.11   Determine process security and cost impact guidelines for proposed applications on intelligent workstations.

> *Client-server computing to include GUI, remote database access, and partitioning of application via RPC technology.*
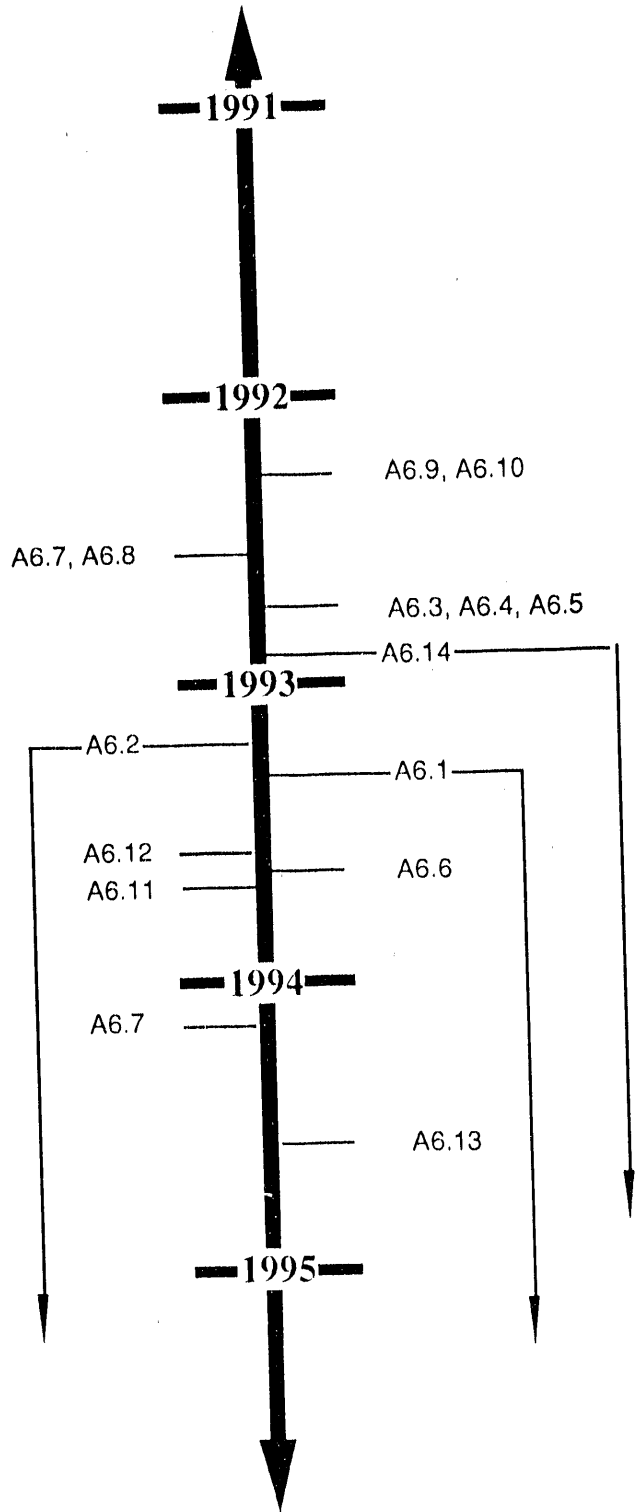
A6.12   Install remote procedure call capability on IRM hosts.

Workstation-based Office Information Systems (OIS).

A6.13   Provide workstation-oriented OIS services, using gateways as required for transition from host-oriented environment.

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Recommended Migration Sequence *

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           A6.7, A6.8 ───

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                          ─A6.14──────────────┐
                          ═1993═
          ─A6.2───────                         │
                          ────── A6.1────┐     │
           A6.12  ───                    │     │
           A6.11  ───   ───  A6.6        │     │

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           A6.7  ───                     │     │

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* Dates for guidance only.

Architecture Strategy

> *A7   Users will be provided with tools to enhance their ability to generate their own database reports and queries.*

Migration Recommendations

Ad hoc query tools using graphical user interfaces.

A7.1   Define end-user reporting and query tool selection criteria and select tool.

A7.2   Define end-user reporting architecture, separating reporting and query functions from transaction processing and storage functions.

Reduction in routine printed reports.

A7.3   Determine reportable process data and define access protocols.

A7.4   Define data and provide an architecture such that classified process data can not be put on unclassified networks.

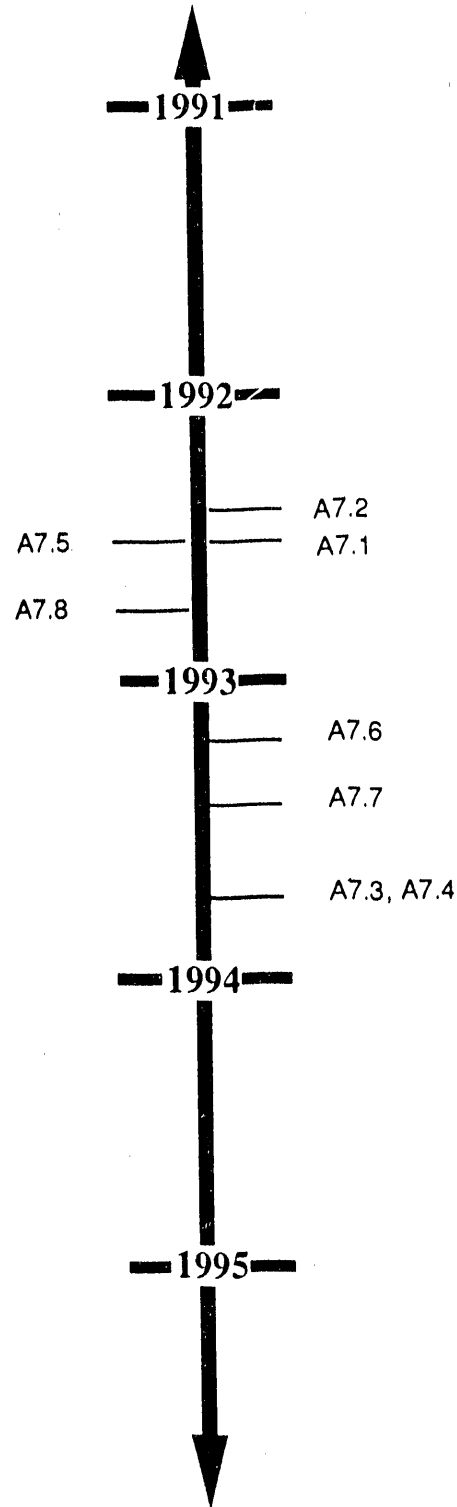A7.5   Define an architecture such that data queries cannot change process control parameters.

Software developers freed from developing customized reports.

Ability to integrate database queries into workstation analysis tools.

A7.6   Provide Dynamic Data Exchange (DDE) support.

A7.7   Provide Remote Data Access support.

A7.8   Determine data access guidelines.

Recommended Migration Sequence *

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           ━━1992━━
           
                      ─────── A7.2
      A7.5  ───────   ─────── A7.1
      
      A7.8  ───────
           ━━1993━━
           
                      ───────  A7.6
                      
                      ───────  A7.7
                      
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Appendix A:
Acronyms

ADP   Automated data processing

API   Applications program interface

BSRI   Bechtel Savannah River Incorporated

CASE   Computer aided software engineering

CAST   Computing Architecture and Standards Team

CCF   Central Computer Facility

CUA   Common User Access (IBM graphical user interface standard)

DB2   IBM's primary relational database management system

DBMS   Database management system

DCE   Distributed Computing Environment (OSF)

DEC   Digital Equipment Corporation

DOE   Department of Energy

ESCC   Engineering and Scientific Computing Committee

Ethernet   Local area network technology (DEC/XEROX/INTEL)

FDDI   Fiber Distributed Data Interface

GIU   Graphical user interface (window-style interface to computer)

GOSIP   Government Open Systems Interface Profile

IBM   International Business Machines Corporation

IEEE	Institute of Electrical and Electronics Engineers
IEEE 802.3	LAN standard for Ethernet
IEEE 802.4	LAN standard for MAP
IEEE 802.5	LAN standard for Token Ring
I/O	Input/output
IRM	Information Resource Management Department, WSRC
ISO	International Standards Organization
LAN	Local area network
MAP	Manufacturing Automation Protocol
mbps	Megabits per second (one million bits per second transmission rate)
MOTIF	Graphical user interface defined by OSF for X-Windows
MS-DOS	Disk operating system for IBM-PC (Microsoft)
MVS	Multiple Virtual Storage (IBM mainframe operating system)
ODIF	Office Document Interchange Format
OODB	Object-oriented database
OOPS	Object-oriented programming system
OS/2	Operating System/2 for IBM PS/2
OSI	Open Systems Interconnection (International Standards Organization)
OSF	Open Systems Foundation
PC	Personal computer (e.g., Mac, IBM)
PC/AT	IBM's 1985 PC offering
PC/XT	IBM's 1982 PC offering
PDEC	Process Digital Equipment Committee
PS/2	IBM Personal System/2 personal computer

POSIX	Portable Operating System Interface (IEEE)
RDA	Remote data access
RDBMS	Relational Database Management System
RPC	Remote Procedure Call
SNA	Systems Network Architecture (IBM)
SNMP	Simple Network Management Protocol
SQL	Structured Query Language
SRS	Savannah River Site
TCP/IP	Transmission Control Protocol/Internet Protocol
UCNI	Unclassified controlled nuclear information
UNIX	Portable operating system (trademark of AT&T)
VAX	Primary DEC computer family
VMS	Virtual Memory System (VAX operating system)
VT100	A DEC dumb terminal
WSRC	Westinghouse Savannah River Company
X/Open	Consortium promoting interoperability
X-Windows	Standard for device-independent text and image network terminals

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